

## Supplementary Online Content

Tyler CW. Evidence that Leonardo da Vinci had Strabismus. *JAMA Ophthalmol*. Published online October 18, 2018. doi:10.1001/jamaophthalmol.2018.3833

**eFigure 1.** Analysis of the oil portrait of ‘Young John the Baptist’ by Leonardo da Vinci (1513-16, Louvre, Paris).

**eFigure 2.** Analysis of the terracotta sculpture of a ‘Young Warrior’ by Andrea del Verrocchio (1470, Bargello, Florence).

**eFigure 3.** Analysis of the ‘Vitruvian Man’ drawing by Leonardo da Vinci (~1490, Accademia, Venice).

**eFigure 4.** Analysis of the reputed self-portrait drawing when old by Leonardo da Vinci (~1515, Biblioteca Reale, Turin).

**eFigure 5.** Analysis of the oil on wood painting ‘Portrait of a Musician’ attributed to Leonardo da Vinci (~1485, Pinacoteca Ambrosiana, Milan).

**eFigure 6.** Analysis of the bronze sculpture of ‘Jesus Blessing St Thomas’ by Andrea del Verrocchio (1482, Orsanmichele, Florence).

**eFigure 7.** Analysis of the painted wood sculpture of ‘John the Baptist’ by Benedetto da Maiano (~1480, National Gallery, Washington, DC).

This supplementary material has been provided by the author to give readers additional information about the work.

eFigures 1 through 4 illustrate the eye alignment analysis of four likely depictions of Leonardo da Vinci that are included in the quantitative analysis described in the main text.

eFigures 5 through 7 illustrate a qualitative analysis of three further possible depictions of Leonardo da Vinci that were in too oblique view or too indistinct to be included in the statistical analysis, but offer qualitative support to the hypothesis that he had some form of exotropia. In eFig. 5, a small exotropia is evident relative to the Hirschberg reflexes (white arrows), although the pupils themselves do not appear to be properly centered in the irises. The two sculptures in eFigs. 6 and 7 also have possible attributions to da Vinci as the model, as described in the captions, and both exhibit a pronounced exotropic eye alignment.

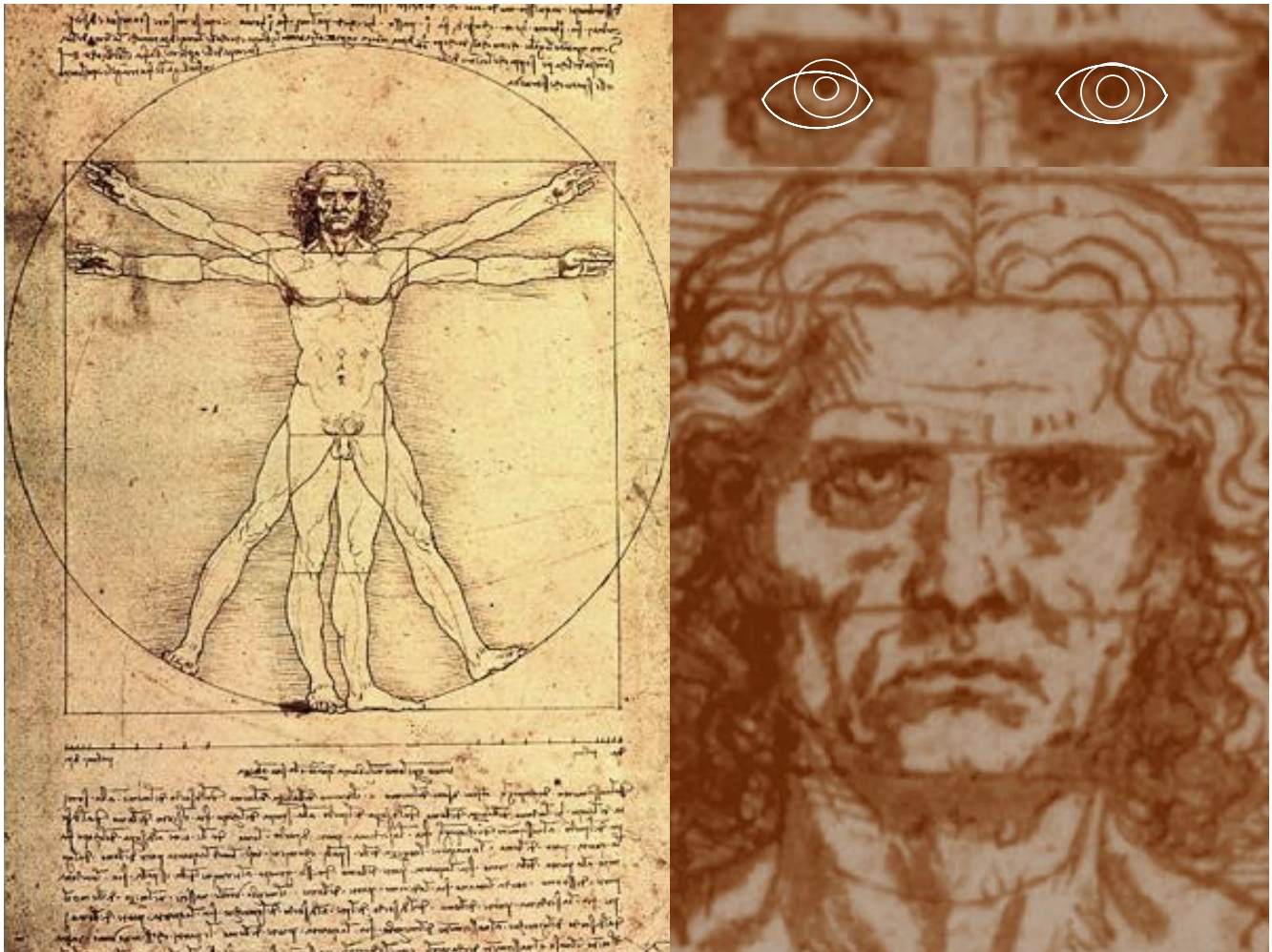


eFigure 1. Left: Oil portrait of 'Young John the Baptist' by Leonardo da Vinci (1513-16, Louvre, Paris). Lower right: Rectified view of the face. Upper right: Exotropic eye alignment delineated by the eyelid aperture, iris and pupil boundaries. This work is in the public domain in its country of origin and other countries and areas where the copyright term is the author's life plus 100 years or less. This work is in the public domain in the United States because it was published (or registered with the U.S. Copyright Office) before January 1, 1923. This file has been identified as being free of known restrictions under copyright law, including all related and neighboring rights.



eFigure 2. Left: Terracotta sculpture of a 'Young Warrior' by Andrea del Verrocchio (1470, Bargello, Florence), plausibly another depiction of the young Leonardo da Vinci. Lower right: Frontal view of the face of the sculpture. Upper right: Exotropic eye alignment delineated by the eyelid aperture, iris and pupil boundaries. This work is in the public domain in its country of origin and other countries and areas where the copyright term is the author's life plus 100 years or less. This file has been identified as being free of known restrictions under copyright law, including all related and neighboring rights.





eFigure 3. Left: The 'Vitruvian Man' drawing by Leonardo da Vinci (~1490, Accademia, Venice) in a frontal pose that would naturally be assumed to be based on himself as the exemplar of the universal man.. Lower right: Detail view of the face. Upper right: Anisocoric pupil configuration delineated by the iris and pupil boundaries. This work is in the public domain in its country of origin and other countries and areas where the copyright term is the author's life plus 100 years or less. This file has been identified as being free of known restrictions under copyright law, including all related and neighboring rights.



eFigure 4. Left: Reputed self-portrait drawing when old by Leonardo da Vinci (~1515, Biblioteca Reale, Turin). Lower right: Detail view of the face. Upper right: Exotropic eye alignment delineated by the eyelid aperture, iris and pupil boundaries. This file is licensed under the Creative Commons Attribution-Share Alike 3.0 Unported license. Sailko, the copyright holder of this work, hereby publishes it under the following licenses: Permission is granted to copy, distribute and/or modify this document under the terms of the GNU Free Documentation License, Version 1.2 or any later version published by the Free Software Foundation; with no Invariant Sections, no Front-Cover Texts, and no Back-Cover Texts. A copy of the license is included in the section entitled GNU Free Documentation License.



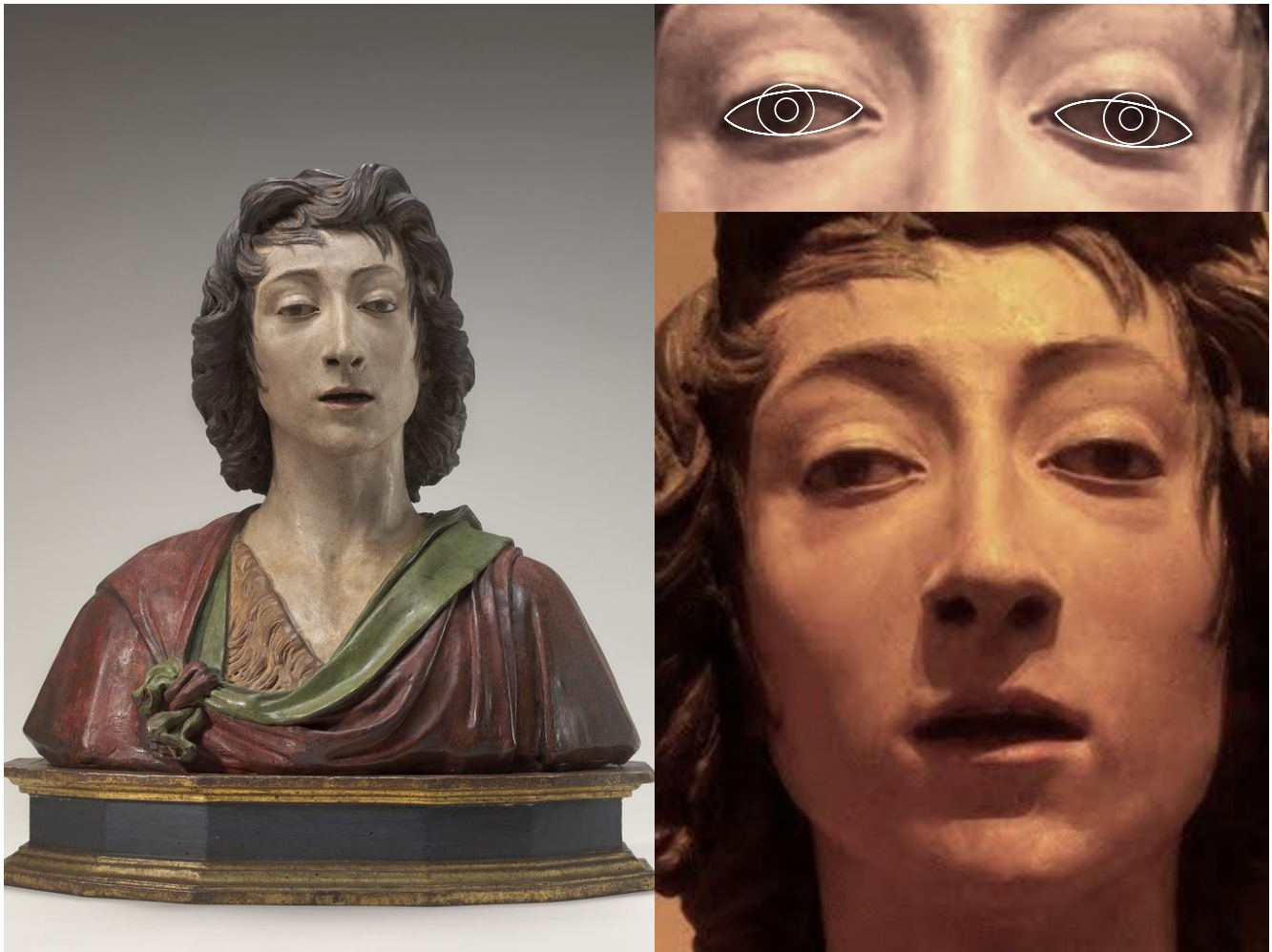


eFigure 5. Left: Oil on wood painting 'Portrait of a Musician' attributed to Leonardo da Vinci (~1485, Pinacoteca Ambrosiana, Milan), possibly another self-portrait of the maturing Leonardo da Vinci. Lower right: Detail view of the face. Upper right: Slight exotropic eye alignment delineated in oblique view by the Hirschberg reflex (white arrows). This work is in the public domain in its country of origin and other countries and areas where the copyright term is the author's life plus 100 years or less. This file has been identified as being free of known restrictions under copyright law, including all related and neighboring rights.



eFigure 6. Left: Bronze sculpture of 'Jesus Blessing St Thomas' by Andrea del Verrocchio (1482, Orsanmichele, Florence), on which Leonardo da Vinci would have been Verrocchio's lead studio assistant and was likely to have been the model for the figure of St Thomas. Lower right: Frontal view of the face of the St Thomas figure. Upper right: Exotropic eye alignment implied by best-estimated eyelid aperture, iris and pupil boundaries. GNU Free Documentation License, Version 1.3, November 3, 2008. Copyright © 2000, 2001, 2002, 2007, 2008 Free Software Foundation, Inc. <<https://fsf.org/>> Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed. (I, the copyright holder of this work, release this work into the public domain. This applies worldwide. In some countries this may not be legally possible; if so: I grant anyone the right to use this work for any purpose, without any conditions, unless such conditions are required by law.)





eFigure 7. Left: Painted wood sculpture of 'John the Baptist' by Benedetto da Maiano (~1480, National Gallery, Washington, DC). Maiano was part of the circle of artists and artisans that included Leonardo da Vinci, who was famous for his preference for pink clothes and for acting as an artist's model, particularly for the rough-hewn John the Baptist based on his country heritage from Vinci. Thus, depicting John the Baptist in pink attire would be a radical break with tradition unless it had the link of deriving from da Vinci as a model. Lower right: Detail view of the face. Upper right: Exotropic eye alignment delineated by the eyelid aperture, iris and pupil boundaries.